

USEPA Data Submittal  
Characterization of Water Quality  
for the Inner, Middle and Outer  
Harbor Waterbodies in the Port of  
Long Beach  
Port of Long Beach,  
California

Prepared for

Port of Long Beach  
925 Harbor Plaza  
P.O. Box 570  
Long Beach, CA 90802

February 2007



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**ACRONYMS AND ABBREVIATIONS**

ASTM	American Society for Testing and Materials
TMDL	Total minimum daily load
CTD	conductivity, temperature and depth
°C	degrees Celsius
COC	chain of custody
CVAFS	cold vapor atomic fluorescence spectrophotometry
DO	dissolved oxygen
GC/FPD	gas chromatography/flame photometric detector
GC-MS	gas chromatography – mass spectrometry
GPS	global positioning system
ICP-MS	inductively coupled plasma – mass spectrometry
m	meter(s)
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pH	hydrogen ion concentration
POLA	Port of Los Angeles
POLB	Port of Long Beach
QA	quality assurance
QC	quality control
SAP	sampling and analysis plan
SIM	selective ion monitoring
SM	standard methods
SVOC	semi-volatile organic compounds
TRPH	total recoverable petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
WAAS	wide area augmentation system

## **1. INTRODUCTION**

This investigation is intended to help facilitate the Port of Long Beach (POLB) in an effort to promote their green port policy. The POLB has infrequently conducted port-wide ambient water quality measurements. In order to update the available information, the POLB requested Weston Solutions, Inc. to perform a water quality survey in conjunction with sediment sampling, performed in October 2006, to support the development of total minimum daily loads (TMDL) requirements for the POLB. This sampling survey was designed to complement the data collected in the neighboring Port of Los Angeles (POLA). This report summarizes the sample collection and processing and presents the results of the survey. This information will help the POLB in its endeavor to continue to meet and exceed the standards set by U.S. Environmental Protection Agency (USEPA) and California State guidelines.

Understanding the physical and chemical characteristics of seawater are important components of any monitoring program. Often, the physical state of the water column will provide clues as to the health of the biological community therein. Dramatic changes in the composition and abundance of a species assemblage can occur as a result of changes in seawater characteristics. However, shifts in certain physical parameters can change due to natural physical and biological forces. Therefore, it is necessary to distinguish between anthropogenic and natural changes. Often times, variations will be cyclically tied to tides, seasons, or weather patterns. Therefore a physical oceanographic characterization should have enough data to be able to distinguish seasonal and tidally driven oceanographic influences. This study aims to help add to what is currently known of the physical and chemical characteristics of the waters within the POLB.

### **1.1 OBJECTIVE**

This data report is intended to supplement the TMDL Sediment Study for POLA and the POLB by providing background water quality parameter information within the POLB. Twenty conductivity, temperature and depth (CTD) casts were conducted throughout the Inner, Middle, and Outer Harbor. Additionally, a midwater sample at each station was taken and analyzed for 160 different chemical constituents.

## 2. MATERIALS AND METHODS

### 2.1 FIELD COLLECTION PROGRAM

#### 2.1.1 Equipment

The *RV Osprey*, a 24-foot fiberglass survey vessel, was used for the collection of mid-depth water samples and deployment of a CTD to profile the entire water column. Mid-depth water samples were collected using a peristaltic pump, pumping water through Teflon<sup>®</sup> tubing. CTD casts were made using a Seabird Electronics SBE 25 Sealogger CTD.

#### 2.1.2 Navigation

On the *RV Osprey*, pre-determined station positions were located using a handheld global positioning system (GPS). The Garmin GPS 76 uses wide area augmentation system (WAAS) correction data and was accurate to within 10 feet. All final station locations were recorded in the field using positions from the handheld GPS.

#### 2.1.3 Sampling Locations and Depths

CTD casts were conducted at twenty stations dispersed throughout the Inner, Middle and Outer Harbor strata. Table 1 lists the twenty sampling locations for the POLB.

Table 1. Water Quality Sample Station Locations and Depth in the Port of Long Beach.

Stratum	Station	Latitude	Longitude	Depth (ft)
Inner Harbor	LBI-3	33° 46.014'	118° 13.977'	46.5
	LBI-4	33° 46.318'	118° 12.302'	12.3
	LBI-5	33° 46.088'	118° 13.201'	51.0
	LBI-6	33° 45.917'	118° 13.316'	44.3
	LBI-7	33° 46.461'	118° 12.873'	37.5
	LBI-8	33° 46.101'	118° 13.403'	42.3
	LBI-9	33° 46.265'	118° 12.737'	43.1
	LBI-10	33° 45.470'	118° 13.085'	58.3
Middle Harbor	LBM-1	33° 44.586'	118° 11.803'	50.6
	LBM-2	33° 45.336'	118° 12.862'	41.2
	LBM-3	33° 44.823'	118° 12.442'	57.5
	LBM-5	33° 45.246'	118° 13.977'	38.0
	LBM-7	33° 44.234'	118° 11.299'	36.5
	LBM-9	33° 44.884'	118° 13.537'	45.8
	LBM-10	33° 44.587'	118° 12.257'	64.1
Outer Harbor	LBO-1	33° 43.298'	118° 13.792'	44.2
	LBO-2	33° 45.203'	118° 11.102'	56.8
	LBO-7	33° 43.924'	118° 11.586'	47.1
	LBO-9	33° 44.121'	118° 13.890'	44.5
	LBO-10	33° 44.028'	118° 12.759'	65.6



Figure 1. Sample Locations within the Port of Long Beach

## 2.1.4 Sample Collection and Handling

### 2.1.4.1 Water Column CTD Profiles

A Seabird Electronics SBE 25 Sealogger CTD was used to conduct all water column profiles. The parameters that are recorded by the Seabird include conductivity, temperature, depth, transmissivity, dissolved oxygen (DO), and hydrogen ion concentration (pH). These data are collected real-time, saved and viewed directly on a laptop computer in the field. After an initial surface soak at 1 m depth for two minutes, the Seabird was lowered steadily at a rate of approximately 0.5 m per second until it contacted the bottom, at which point the unit was brought to the surface. Only data obtained from the down cast was used in this study.

After downloading and archiving, the raw data were then digitally processed, which involved filtering and averaging into 1 m depth bins. The processed data are provided in Appendix A, and represented graphically in Figure 2 through Figure 4.

#### 2.1.4.2 Mid-Depth Water Samples

A peristaltic pump, pumping water from mid-depth in the water column through Teflon<sup>®</sup> tubing was used to collect the mid-depth water samples. The tubing was lowered in a controlled manner until the intake was located in the middle of the water column (water column depths were taken from a fathometer on board the research vessel). An initial three liters of water was pumped through the system and discarded prior to collecting the mid-depth water samples into pre-cleaned sample bottles appropriate for each specified analysis.

#### 2.1.5 Sample Storage

Water samples for chemistry analysis were labeled, placed on ice, and shielded from light until delivered to CalScience Environmental Laboratories. Any water not immediately analyzed was stored at 4°C at the Weston laboratory in Carlsbad until chemical characterization was completed.

#### 2.1.6 Documentation and Chain-of-Custody

The principal documents used to identify samples and to document possession were Chain-of-Custody (COC) records, field logbooks, and field tracking forms. COC procedures were used for all samples throughout the collection, transport, and analytical process, and for all data documentation, whether in hard copy or electronic format.

COC forms were completed and placed in a plastic sealed envelope that traveled inside the ice chest containing the listed samples. The person transferring custody of the samples signed the COC form. The receiver recorded the condition of the samples. COC records were included in the final analytical report prepared by the laboratory, and were considered an integral part of that report. Samples were considered to be in custody if they were: (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Minimum documentation of sample handling and custody included the following

- Sample identification
- Sample collection date and time
- Any special notations on sample characteristics
- Initials of the person collecting the sample
- Date the sample was sent to the laboratory

## 2.2 CHEMICAL ANALYSES

Physical and chemical parameters to be measured in this testing program were selected to provide data on potential chemicals of concern in the Port's waterbodies. All analytical methods used to obtain contaminant concentrations follow USEPA, Standard Methods (SM) or American Society for Testing and Materials (ASTM) procedures. The specific chemistry analyses and target detection limits for this project were described in the sampling and analysis plan (SAP; Weston 2006).

### 2.2.1 Chemical Analyses Mid-Depth Water Samples

The analysis for priority pollutant metals (except mercury) was conducted using an inductively coupled plasma emissions spectrometer equipped with a mass detector (ICP-MS), in accordance with USEPA 6020m. In porewater and sediment, mercury analysis was conducted using cold vapor atomic fluorescence spectrophotometry (CVAFS) in accordance with USEPA 245.7m. The analysis for total and dissolved sulfides followed SM 4500 S2-D. The analysis for ammonia followed SM4500-NH3F. Oil and grease was measured using USEPA 1664A. Total recoverable petroleum hydrocarbons (TRPH) was measured by USEPA 418.1.

Acid extractable compounds and semivolatile organics (SVOC) including polycyclic aromatic hydrocarbons (PAHs), chlorinated pesticides, and polychlorinated biphenyls (PCBs), were analyzed using gas chromatography-mass spectrometry (GC/MS) with selected ion monitoring (SIM) according to USEPA Method 8270M. This method followed serial extraction with methylene chloride and alumina and gel permeation column cleanup procedures. PCBs were identified as Aroclors and individual congeners, separately. Organotins were analyzed using gas chromatograph/flame photometric detector (GC/FPD). The analytical method used to determine tributyltin involved methylene chloride extraction, followed by Grignard derivatization and analyzed by GC/MS (Krone et al., 1989).

### 2.2.2 Quality Assurance Procedures

The quality assurance (QA) objectives for chemical analysis conducted by the participating analytical laboratories are detailed in their Laboratory QA Manual(s). These objectives for accuracy and precision involved all aspects of the testing process, including the following:

- Methods and Standard Operating Procedures
- Calibration methods and frequency
- Data analysis, validation, and reporting
- Internal quality control (QC)
- Preventive maintenance
- Procedures to ensure data accuracy and completeness

Results of all laboratory QC analyses were reported with the final data.

### 2.2.3 Data Analysis and Statistical Methods

Major deviations from prescribed protocols required approval of both the client and the QC manager. Circumstances or deviations that might affect the integrity of the study were reported with the results. The data, analyses, and report were also reviewed for accuracy by the QA manager. All data underwent a 100% QA check for accuracy and completeness, and an additional secondary check was performed on a minimum of 10% of the data.

### **3. RESULTS**

#### **3.1 SAMPLE COLLECTION AND HANDLING**

Field activities were conducted during the first half of October, with sampling occurring in the POLB on October 2-6, 2006. Sampling was typically conducted under clear to partly cloudy skies with light winds increasing throughout the day. The seas were typically calm in the Inner and Middle Harbors with mildly choppy conditions in Outer Harbor.

#### **3.2 WATER COLUMN CTD PROFILES**

Water column monitoring was conducted throughout the Inner, Middle and Outer Harbor. Since the CTD casts coincided with other more time intensive water sampling events, profiling of the entire harbor area was completed over the duration of four days (October 2-6, 2006). All data were processed into 1 m depth bins for each parameter and are presented in Appendix A. The data are profiled graphically in Figure 2 through Figure 4.

#### **3.3 CHEMICAL ANALYSES**

A total of 160 chemical constituents were analyzed from the midwater samples taken at the 20 stations throughout the Inner, Middle, and Outer Harbor regions. These fell into seven different categories of analytes, including (1) general chemical constituents, (2) metals, (3) PCB congeners, (4) PCB aroclors, (5) organotins, (6) SVOC, and (7) pesticides. All analytical methods used to obtain chemical concentrations followed USEPA, SM or ASTM procedures. Specific analytical methods and target reporting limits for each analyte were provided in the SAP generated for this project (Weston 2006). Results from the chemical analyses are provided in Appendix B.

Figure 2. CTD casts for the Port of Long Beach Inner Harbor sites.

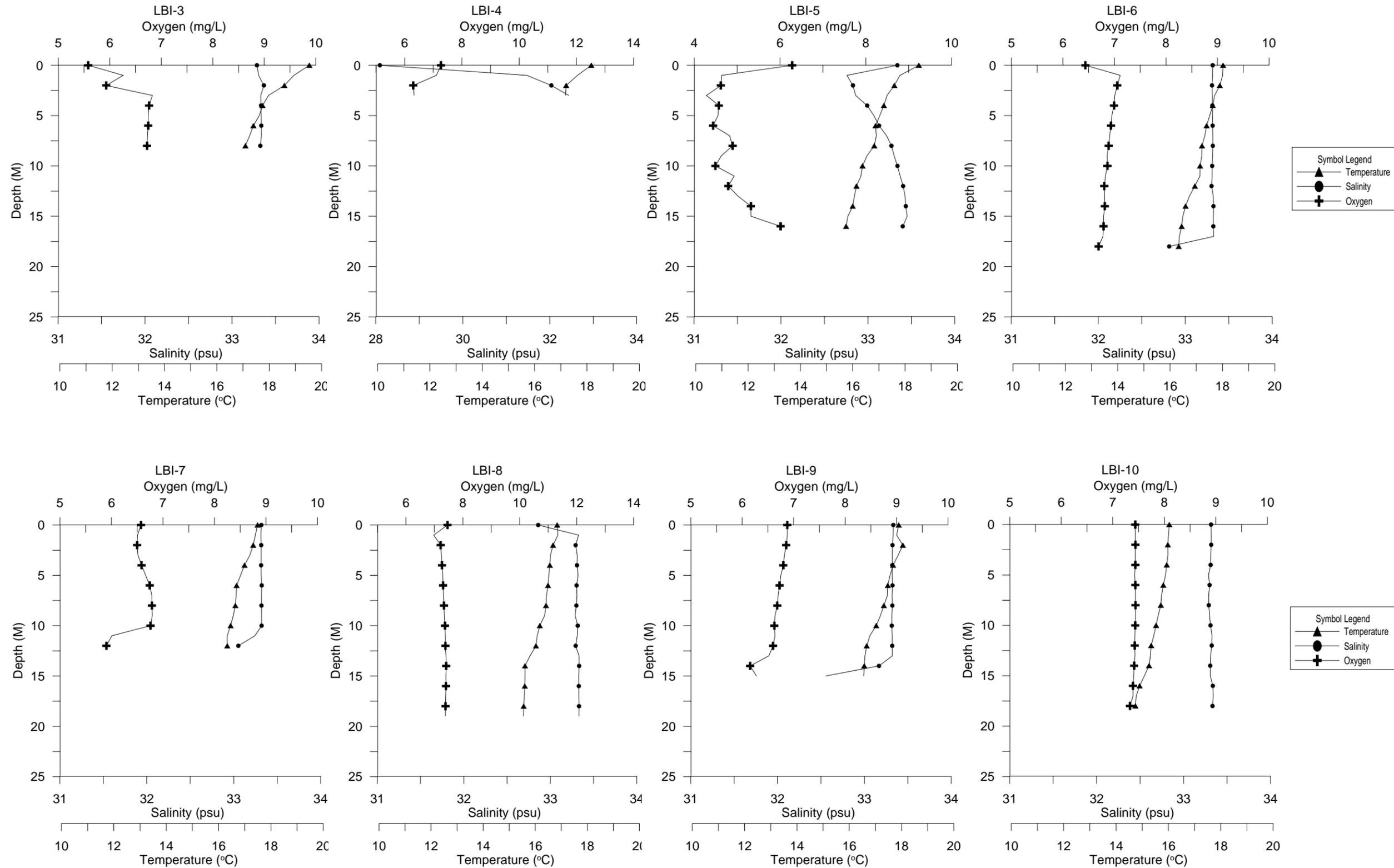


Figure 3. CTD casts for the Port of Long Beach Mid Harbor sites.

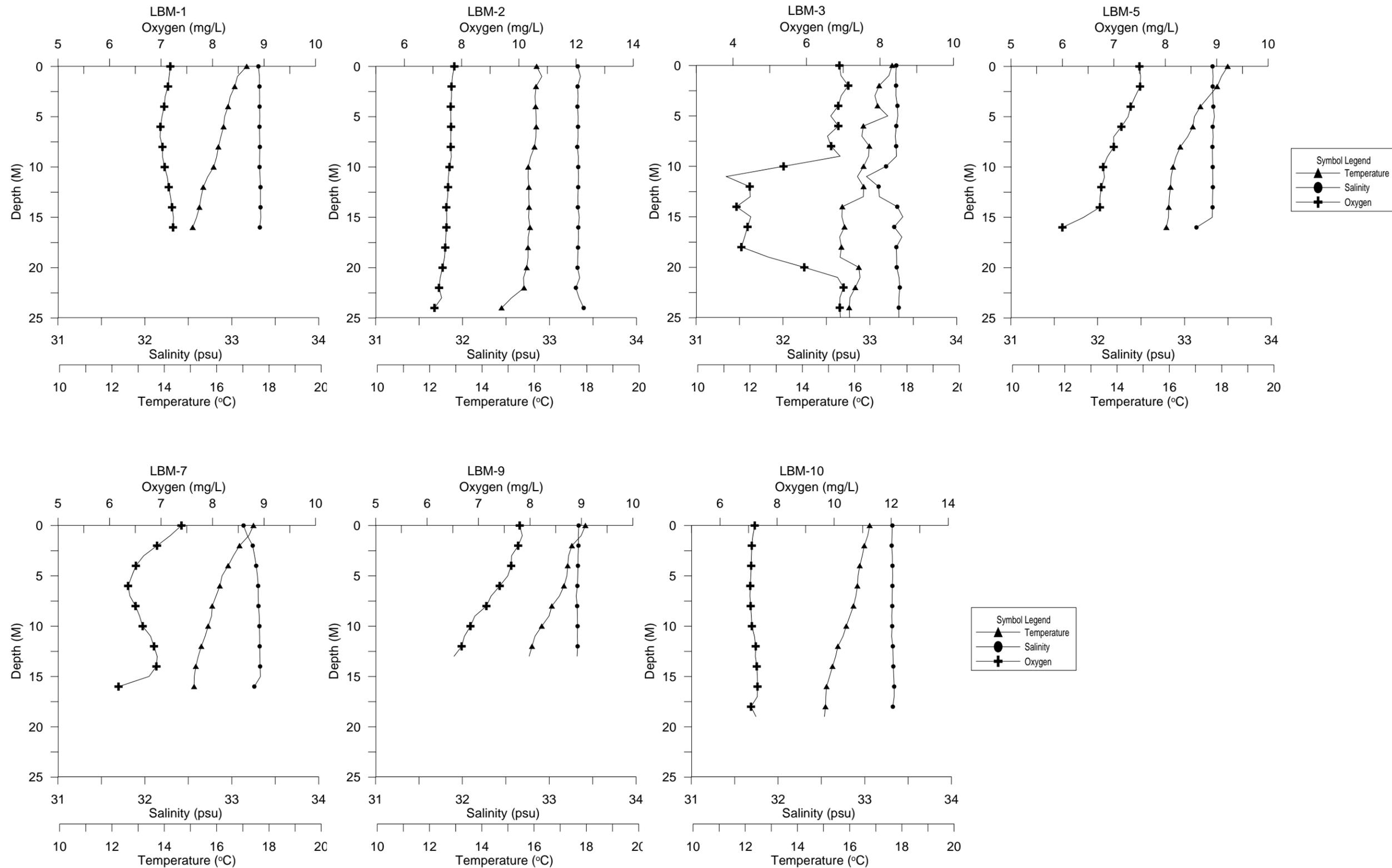
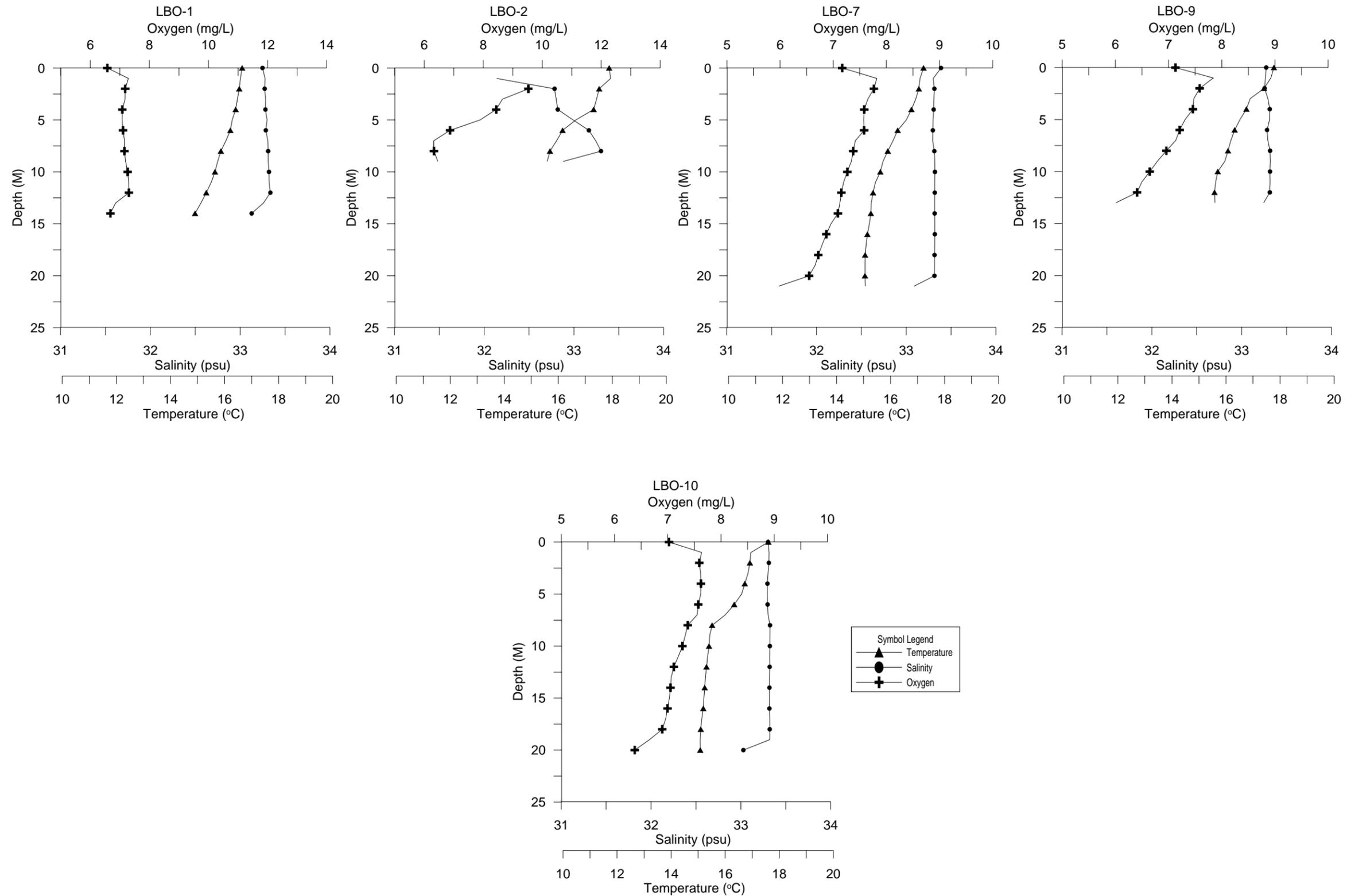


Figure 4. CTD casts for the Port of Long Beach Outer Harbor sites.



#### **4. REFERENCES**

Krone, C.A., D.W. Brown, D.G. Burrows, R.G. Bogar, S.-L. Chan, and U. Varanasi. 1989. A method for analysis of butyltin species and measurement of butyltins in sediments and English Sole livers from Puget Sound. *Marine Environmental Research*, 27:1-18.

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**Appendix A**  
**Water Column CTD Profiles**

**Appendix B**  
**Water Quality Data**